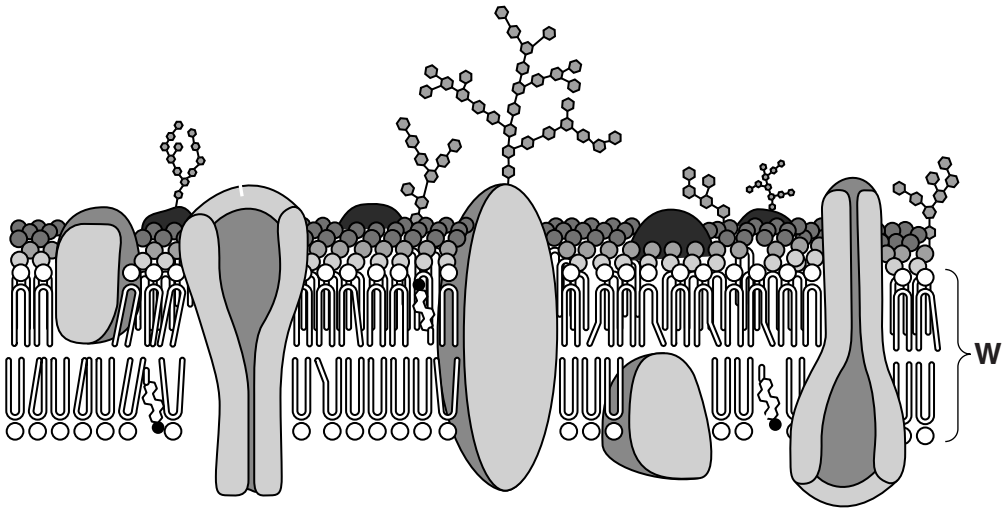
A LEVEL Biology

4. Cell Membrane & Transport

Paper 1



Updated to May 2025

Classified by Mr.Adeel Ahmad

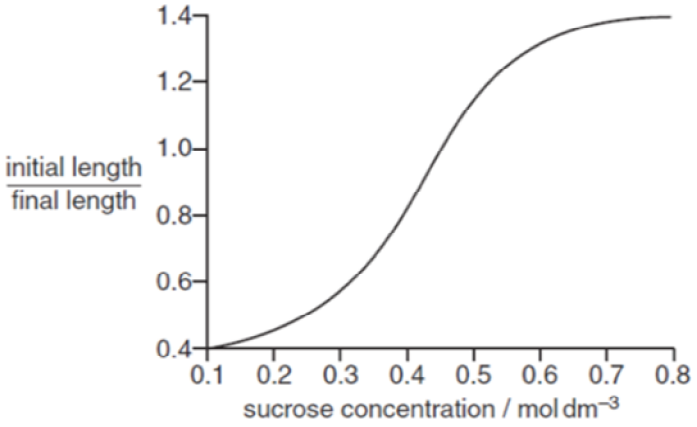
Answers of Q.1 to Q. 89 on Page 35

4. Cell Membranes & Transport

1.

Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes in the different solutions.

The graph shows the ratio of initial length to final length.

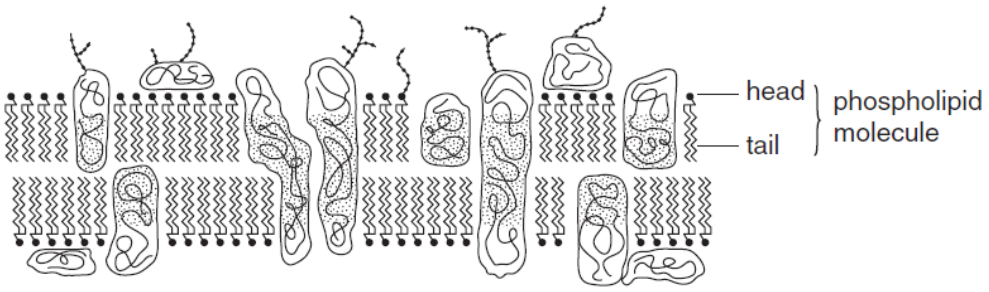


Which concentration of sucrose solution, in mol dm^{-3}, has the same water potential as the cell sap before immersion?

A 0.1 **B** 0.25 **C** 0.45 **D** 0.8

2.

The diagram shows a section of a cell surface membrane.



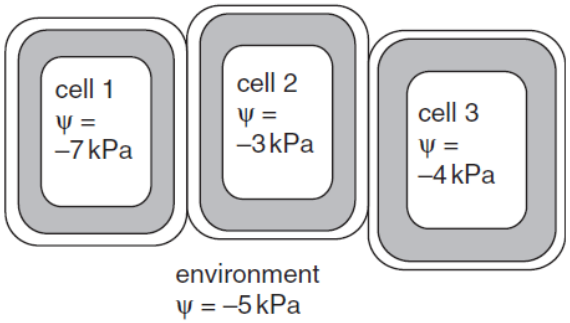
What causes the phospholipid molecules to be arranged as shown?

A The heads are hydrophilic and point towards water molecules.

B The heads are hydrophobic and point away from water molecules.

C The tails are hydrophilic and point away from water molecules.

D The tails are hydrophobic and point towards water molecules.

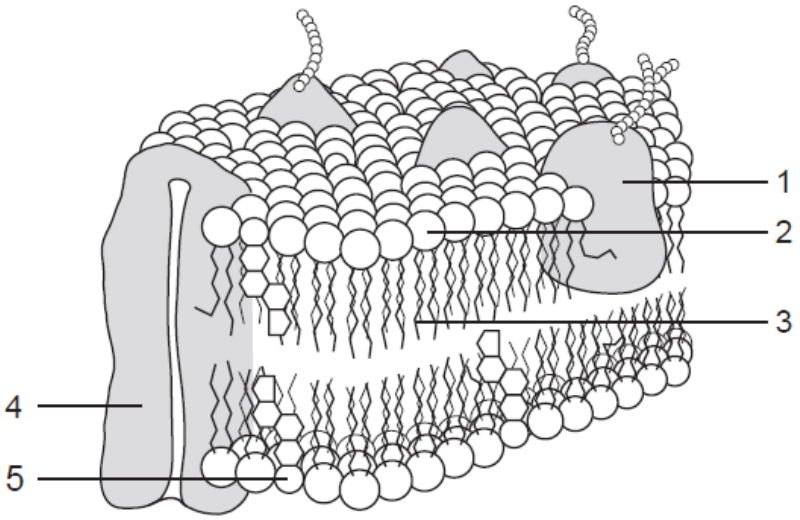
3.	**6** Many fresh water animals possess vacuoles which contract regularly, expelling excess water. Why do plants living in fresh water **not** require such vacuoles? **A** Plant cell sap has a much lower concentration of dissolved solutes than animal cytoplasm. **B** Plant cell walls are impermeable to water. **C** The water potential is the same inside and outside the plant cells. **D** Water movement into plants is controlled by their roots.
4.	The diagram shows the water potential (ψ) in some plant cells and in their environment.  Which statement describes the movement of water between these cells and between them and their environment? **A** All three cells are turgid, so no water moves. **B** Water moves from cell 1, cell 3 and the environment into cell 2. **C** Water moves from cell 3 to the environment, and from the environment to cell 1. **D** Water moves from the environment into cells 1, 2 and 3.
5.	Which process is the movement of molecules that are too large to diffuse in through a cell surface membrane? **A** active transport **B** endocytosis **C** facilitated diffusion **D** osmosis

6. A plant cell is placed in a solution with a less negative (higher) water potential than the cell contents.

Which change occurs in the cell and what causes the change?

	change	cause
A	cell becomes more flaccid	solution diffuses out of the cell
B	cell becomes more flaccid	water diffuses out of the cell
C	cell becomes more turgid	solution diffuses into cell
D	cell becomes more turgid	water diffuses into cell

7. The diagram shows part of the cell surface membrane.



Which components help to maintain the fluidity of the membrane?

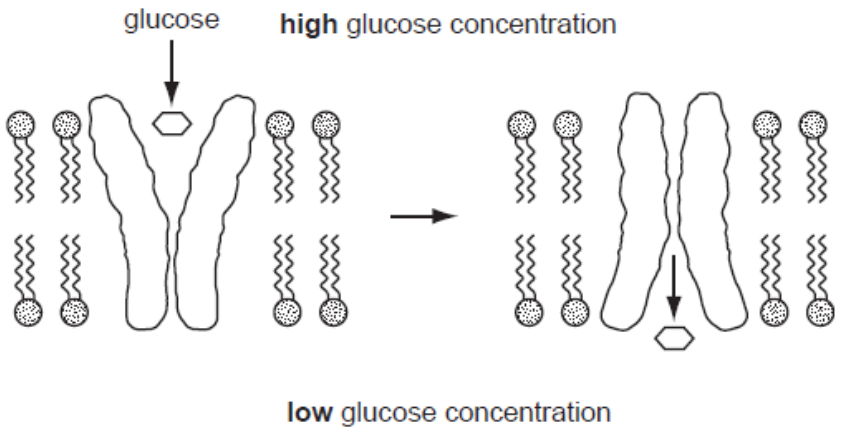
A 1 and 3

B 1 and 4

C 2 and 4

D 3 and 5

8. The diagram represents stages in glucose uptake through a cell surface membrane.



Which process is shown?

A active transport

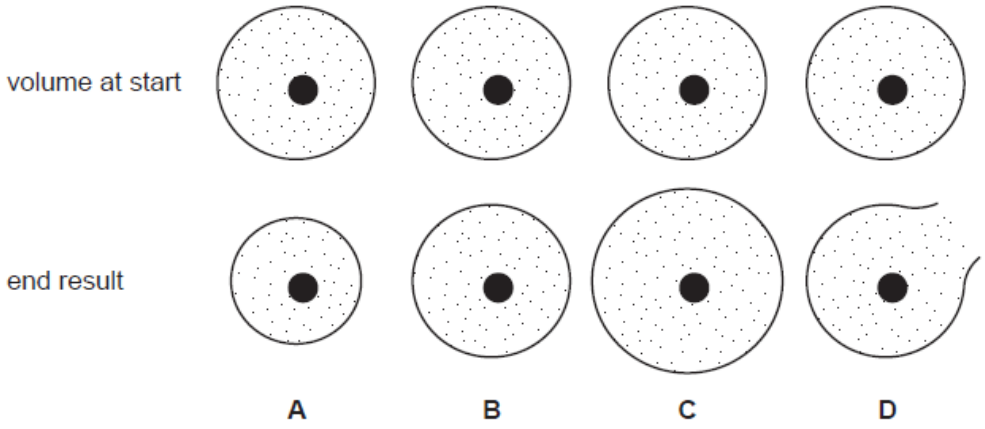
B facilitated diffusion

C osmosis

D simple diffusion

9. Identical animal cells were placed in solutions of differing water potentials. The diagram shows the volume of the cells at the start and the end result.

Which cell was placed in the solution with the lowest (most negative) water potential?



10. Which molecule prevents the cell surface membrane from becoming too fluid or too rigid?

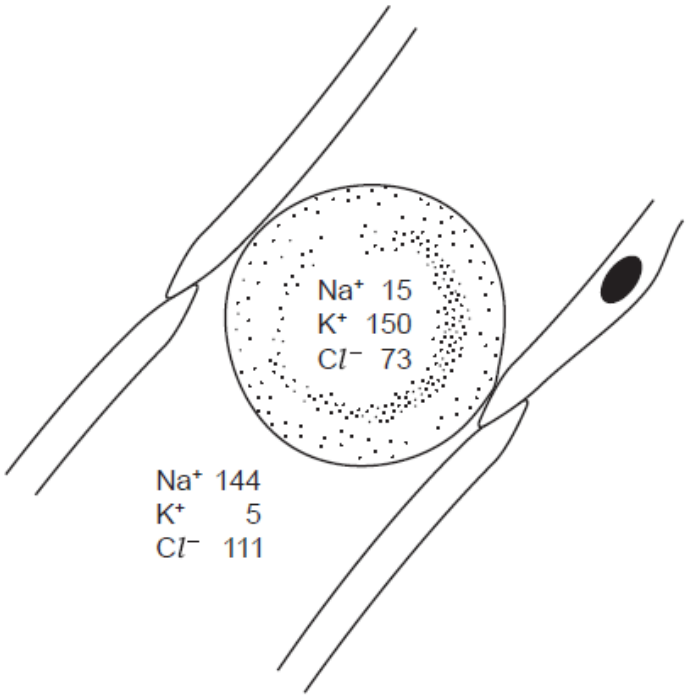
A cholesterol

B glycolipid

C glycoprotein

D phospholipid

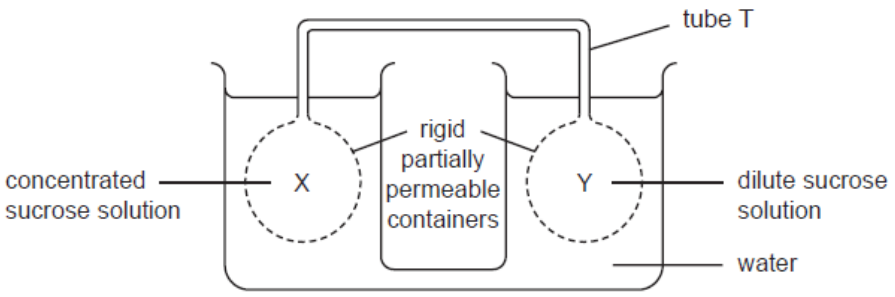
11. The diagram shows a red blood cell and the concentrations of ions, in mmol dm^{-3}, in the pla and in the cell.



Which ions are actively transported into and out of the cell?

	into cell	out of cell
A	Cl^-	K^+
B	K^+	Na^+
C	Na^+	Cl^-
D	Na^+	K^+

12. The diagram shows a model which can be used to demonstrate mass flow.



X and Y are filled with sucrose solutions of different concentration, causing water to move in or out of X and Y by osmosis or as a result of hydrostatic pressure. Sucrose solution then moves through the tube T joining X and Y.

Which description of this is correct?

	water potential in X compared with Y	direction of movement of sucrose solution in tube T
A	higher (less negative)	from X to Y
B	higher (less negative)	from Y to X
C	lower (more negative)	from X to Y
D	lower (more negative)	from Y to X

13. Which adaptation would increase the efficiency of active transport of carbohydrates from a plant cell?

A areas where the cell wall is thin

B increased permeability of the cell wall

C large surface area of the cell surface membrane

D selective permeability of the vacuole membrane

14. Which statement defines active transport?

A movement of large molecules through the cell surface membrane into the cytoplasm of a cell

B movement of molecules or ions from where they are in a low concentration to where they are in a higher concentration

C movement of molecules or ions from where they are in a high concentration to where they are in a lower concentration

D net movement of water molecules across a partially permeable membrane from a region of higher water potential to one of lower water potential

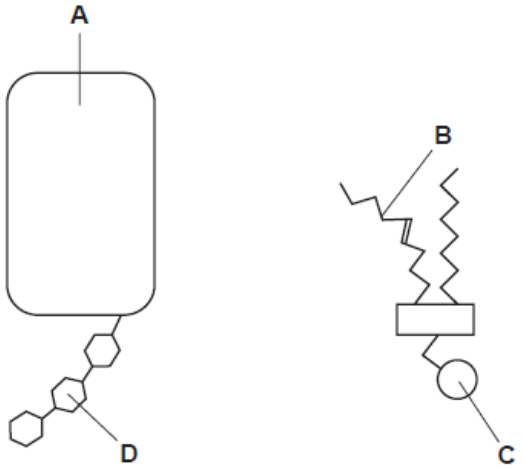
15. Which pair of factors is inversely proportional to the rate of diffusion?

A concentration gradient and size of diffusing molecule

B distance over which diffusion occurs and surface area over which diffusion occurs

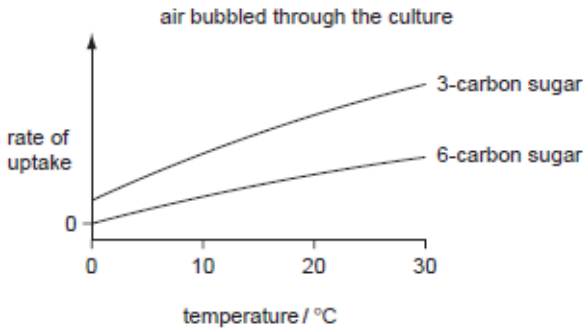
C size of diffusing molecule and distance over which diffusion occurs

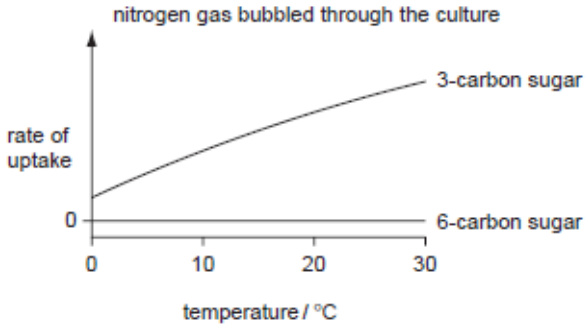
D surface area over which diffusion occurs and concentration gradient

16.	When cylinders of potato tissue were immersed in a 0.35 mol dm^{-3} sucrose solution, they showed no change in mass. What will happen when cylinders are immersed in a 0.1 mol dm^{-3} sucrose solution? **A** The pressure potential of the cells will become more positive. **B** The solute potential of the cell will become more negative. **C** The water potential of the cells will become more negative. **D** The water potential of the solution will become less negative.
17.	The diagrams show two kinds of molecules found in cell surface membranes. Which part affects the fluidity of the membrane? 

18.

15 The graphs show the rate of uptake of sugars by a culture of animal cells, under different conditions.





How are the sugars taken up by the cells when air is bubbled through the culture?

	3-carbon sugar	6-carbon sugar
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

19. Which process allows the movement of molecules that are too large to pass **in** through a cell surface membrane?

A active transport

B endocytosis

C exocytosis

D facilitated diffusion

20. Membranes in cells include the following components.

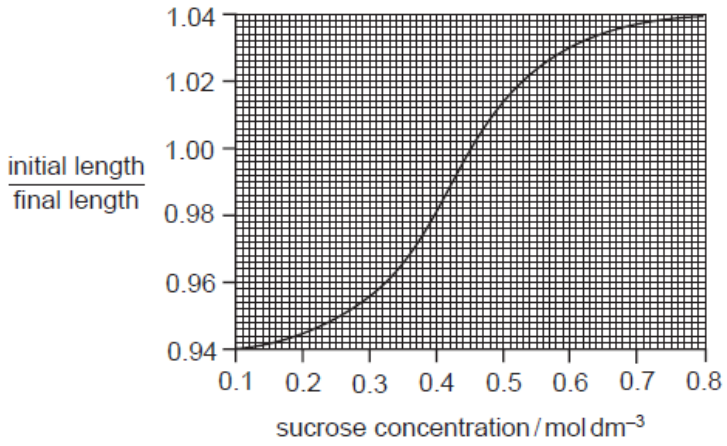
1 cholesterol
2 glycoproteins
3 phospholipids
4 proteins

Which component is the most important for these functions of membranes?

function	recognising self / non self	separating dissolved ions	stabilising the hydrophobic layer	transporting ions through membranes
A	1	2	3	4
B	2	3	1	4
C	3	1	4	2
D	3	4	1	2

21. Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes in the different solutions.

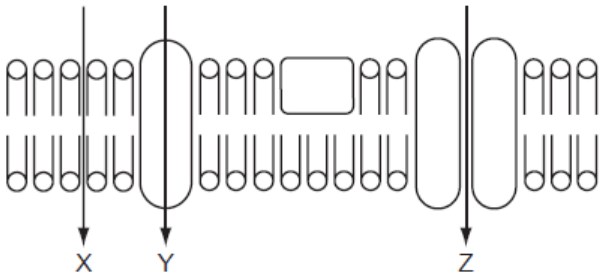
The graph shows the ratio of initial length to final length.



Which concentration of sucrose solution, in mol dm^{-3}, has the same water potential as the cell sap before immersion?

A 0.1 **B** 0.25 **C** 0.45 **D** 0.8

22. The diagram shows three routes through which substances can pass across a cell membrane.



Which correctly shows the routes for vitamin D, which is fat soluble, and vitamin C, which is water soluble?

	vitamin D	vitamin C
A	Y	X
B	X	Z
C	X	Y
D	Z	Y

23. Some viruses are able to bind to the cell surface membrane before entering the host cell.

Which sequence of events will lead to a virus invading a cell?

A binding to a cholesterol molecule, followed by endocytosis

B binding to a glycoprotein receptor, followed by exocytosis

C binding to a protein receptor, followed by endocytosis

D binding to the hydrophilic portion of a phospholipid, followed by exocytosis

24. Which statement about the fluid mosaic model of membrane structure is correct?

A The less unsaturated the fatty acid tails of the phospholipid, the more fluid the membrane.

B The more unsaturated the fatty acid tails of the phospholipid, the more fluid the membrane.

C The higher the temperature, the less fluid the membrane.

D The lower the temperature, the more fluid the membrane.

25. Which pair of factors is inversely proportional to the rate of diffusion?

A concentration gradient and surface area over which diffusion occurs

B distance over which diffusion occurs and size of diffusing molecule

C size of diffusing molecule and concentration gradient

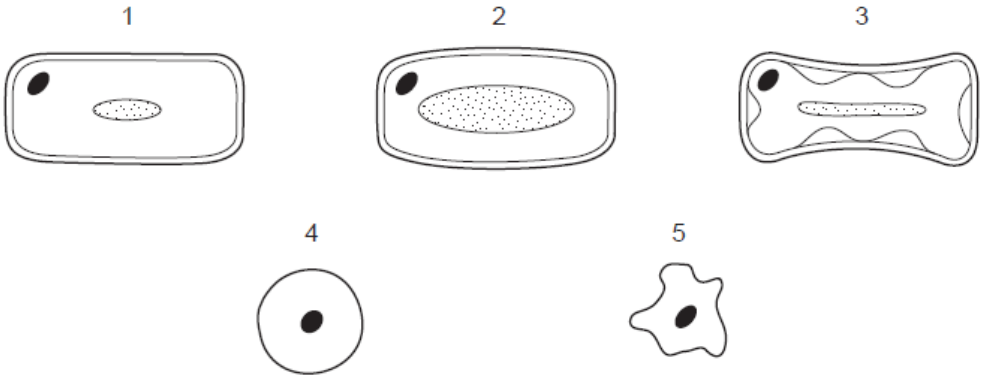
D surface area over which diffusion occurs and distance over which diffusion occurs

28. Which processes allow movement into and out of a cell?

1 active transport
2 diffusion
3 facilitated diffusion
4 osmosis

A 2 and 4 only
B 1, 2 and 3 only
C 1, 3 and 4 only
D 1, 2, 3 and 4

29. Some plant and animal cells were placed in different solutions and the results are shown.



Which cells were placed in which solution?

	1.0 mol dm^{-3} sucrose	0.1 mol dm^{-3} salt solution
A	1 and 2	3 and 5
B	1 and 4	3
C	2 and 4	1 and 3
D	3 and 5	2 and 4

32. What is correct for the cell surface membrane and membranes within cells?

A Both allow intracellular transport.

B Both are stabilised by glycoproteins.

C Both have sites for enzyme attachment.

D Both protect cells from the contents of lysosomes.

33. What supports the view that a membrane protein is involved in active transport?

A It allows movement of molecules across a membrane if concentration differences exist.

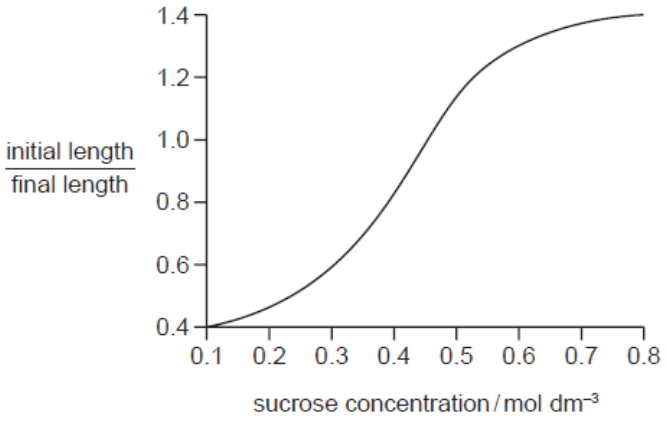
B It can only function if mitochondria are supplied with sufficient oxygen.

C It has a tertiary structure with a binding site with a specific shape.

D It is found in the cell surface membranes and the mitochondrial membranes.

34. Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes.

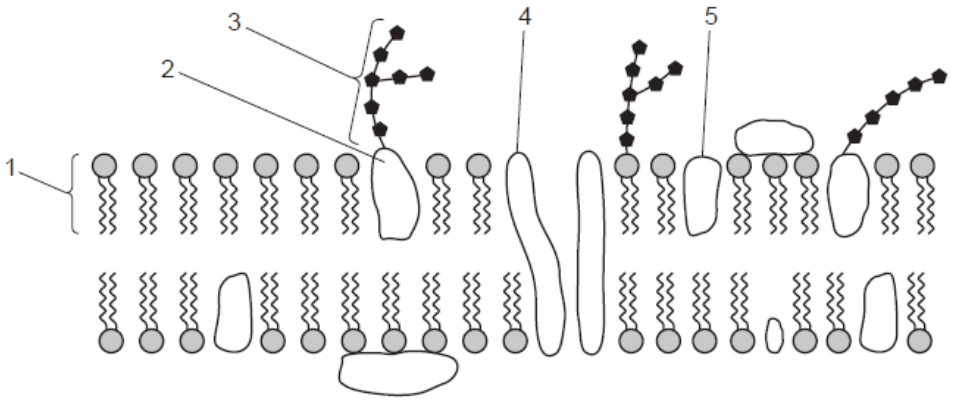
The graph shows the ratio of initial length to final length.



What is a correct description of the change in the cells and in their water potential as the sucrose concentration increases?

	change in the cells	change in the water potential
A	less turgid	more negative
B	less turgid	less negative
C	more turgid	less negative
D	more turgid	more negative

35. The diagram shows part of a cell surface membrane.



Which molecules have both hydrophobic and hydrophilic regions?

A 1 and 5 only

B 1, 3 and 5 only

C 1, 2, 4 and 5 only

D 2, 3 and 4 only

36. Increasing which type of bond helps to increase the fluidity of the cell surface membrane?

A C—O—C

B C—N

C C=C

D hydrogen

37. When cylinders of potato tissue were immersed in a 0.35 mol dm^{-3} sucrose solution, they showed no change in mass.

What will happen when cylinders are immersed in a 0.1 mol dm^{-3} sucrose solution?

A The pressure potential of the cells will become more positive.

B The solute potential of the cell will become more negative.

C The water potential of the cells will become more negative.

D The water potential of the solution will become less negative.

38. What supports the view that a membrane protein is involved in active transport?

A It allows movement of molecules across a membrane if concentration differences exist.

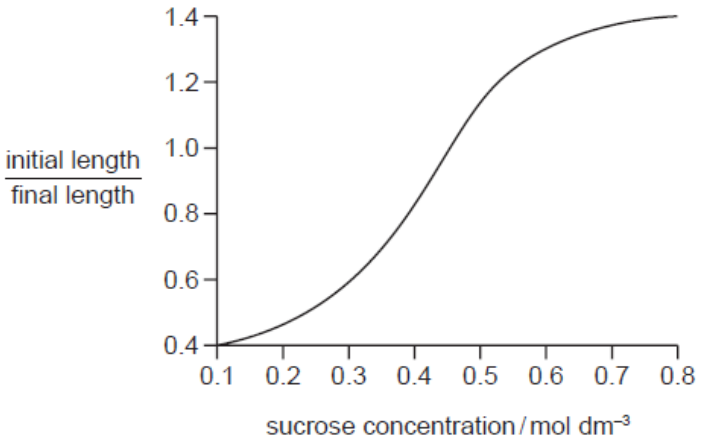
B It can only function if mitochondria are supplied with sufficient oxygen.

C It has a tertiary structure with a binding site with a specific shape.

D It is found in the cell surface membranes and the mitochondrial membranes.

39. Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes.

The graph shows the ratio of initial length to final length.

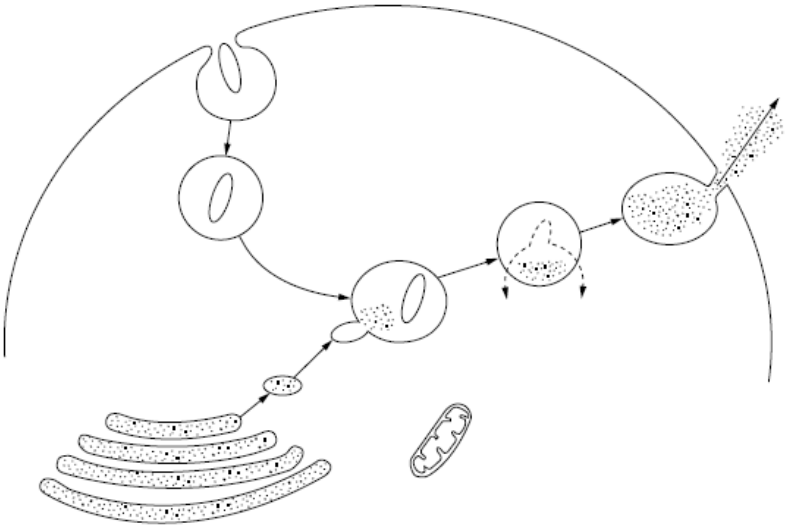


What is a correct description of the change in the cells and in their water potential as the sucrose concentration increases?

	change in the cells	change in the water potential
A	less turgid	more negative
B	less turgid	less negative
C	more turgid	less negative
D	more turgid	more negative

40.

The diagram shows several processes taking place in a cell.



Which processes are shown in the diagram and involve the cell surface membrane of the cell?

A active transport and diffusion

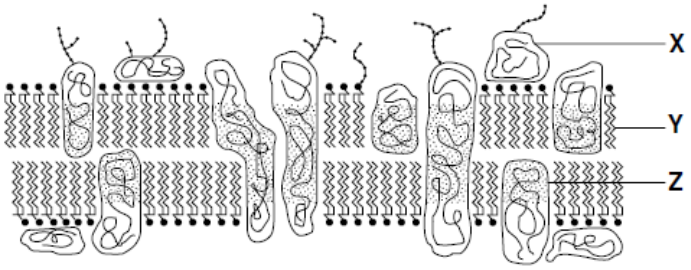
B diffusion and osmosis

C endocytosis and exocytosis

D endocytosis and osmosis

41.

The diagram shows part of a cell surface membrane.



Which labels are correct?

	glycoprotein	phospholipid	protein
A	X	Y	Z
B	Y	Z	X
C	Y	X	Z
D	Z	Y	X

42. Which adaptation would increase the efficiency of active transport of carbohydrates from a plant cell?

A areas where the cell wall is thin

B increased permeability of the cell wall

C large surface area of the cell surface membrane

D large volume of the cell vacuole

43. Turgid plant tissue is placed in a solution which has the same solute potential as the contents of the cells. The diagram shows a cell after one hour.

Which equation describes the value of the pressure potential for this cell?

A pressure potential = solute potential of the cell

B pressure potential = solute potential of the external solution

C pressure potential = water potential of the cell

D pressure potential = zero

44. Which part of a phospholipid molecule makes up most of the thickness of a cell surface membrane?

A glycerol

B hydrocarbon chains

C hydrophilic head

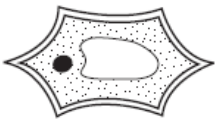
D phosphate group

45. The diagram shows a plant cell.

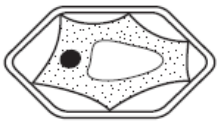
The plant cell is put into a solution with a water potential less negative (higher) than the cell contents.

What will happen to the appearance of the cell?

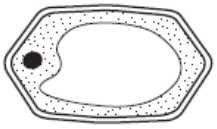
A



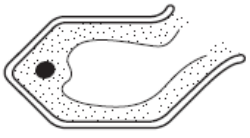
B



C



D



46. Which structures are present in large numbers at sites of active transport?

A Golgi bodies

B lysosomes

C mitochondria

D rough endoplasmic reticulum

47. What are the features of facilitated diffusion?

	uses protein channels in membrane	uses ATP	molecules move down a concentration gradient
A	✗	✓	✗
B	✗	✗	✓
C	✓	✗	✓
D	✓	✓	✗

48. The table shows three processes that contribute to transport across cell surface membranes.

Which processes are the result of random movement of molecules?

	diffusion	endocytosis	osmosis
A	✗	✗	✗
B	✗	✓	✓
C	✓	✗	✓
D	✓	✓	✗

key

✓ = random

✗ = non random

49. Red blood cells were placed in a solution of sodium chloride with a water potential higher (less negative) than the cell contents. Haemoglobin was released from the cells.

By what process was the haemoglobin released?

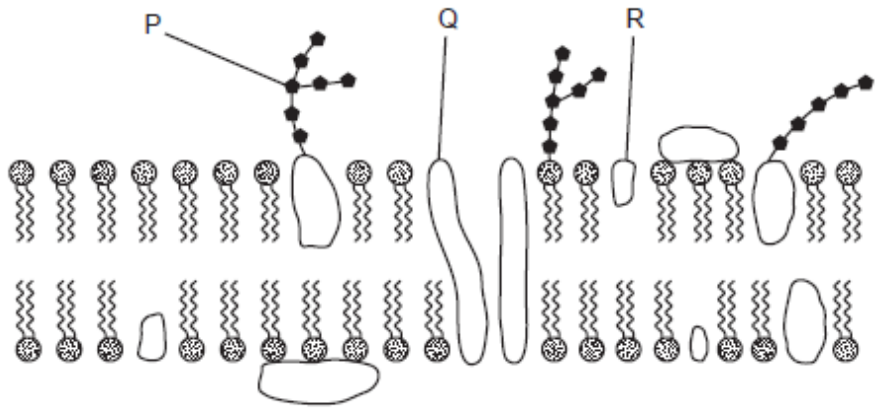
A active transport

B exocytosis

C facilitated diffusion

D lysis of cell

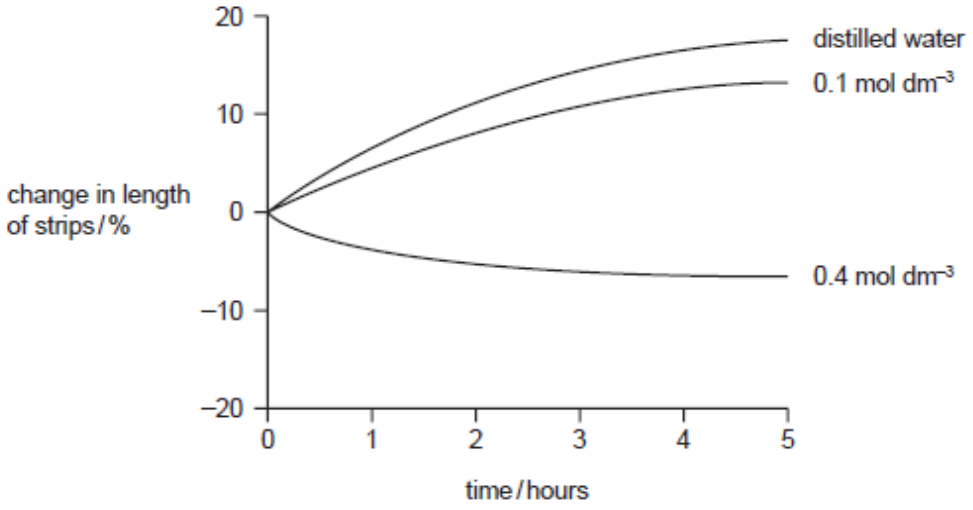
50. The diagram shows part of a cell surface membrane.



What is the correct function for each of the structures labelled?

	regulates membrane fluidity	forms hydrogen bonds with water to stabilise membrane	transports ions and large polar molecules
A	R	R	Q
B	P	Q	R
C	Q	R	P
D	R	P	Q

51. Strips of potato tuber tissue were immersed in distilled water or in sucrose solutions of different concentrations. The graph shows the percentage change in length of the strips.



Which statement explains the change that occurred in the potato strips immersed in 0.1 mol dm^{-3} sucrose solution?

A Sucrose molecules diffused into the potato cells.

B Sucrose molecules were actively transported into the potato cells.

C The water potential of the sucrose solution was less negative than the water potential inside the cells.

D The water potential of the sucrose solution was more negative than the water potential inside the cells.

52. Which process would allow the movement of large protein molecules **out** of the cell?

A active transport

B exocytosis

C facilitated diffusion

D phagocytosis

53. An investigation was carried out into the effect of various chemicals on the permeability of the plasma membrane and tonoplast of beetroot cells. Beetroot cell vacuoles contain a red pigment, which cannot pass out of the cells because it cannot diffuse through their tonoplasts and plasma membranes.

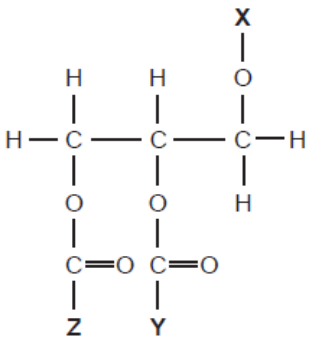
1 cm^3 cubes were cut from beetroot and washed in running water for twenty minutes to remove any pigment released from damaged cells.

They were then placed in different solutions and the results observed. In each case the solution turned red.

What shows the correct behaviour of phospholipids and proteins in different solutions?

	solution	phospholipids dissolve	solution	protein denatures
A	dilute HC*l*	✓	water at 40 °C	✓
B	dilute HC*l*	✓	ethanol	✓
C	ethanol	✓	dilute HC*l*	✓
D	water at 40 °C	✓	ethanol	✓

54. The diagram shows a phospholipid molecule.

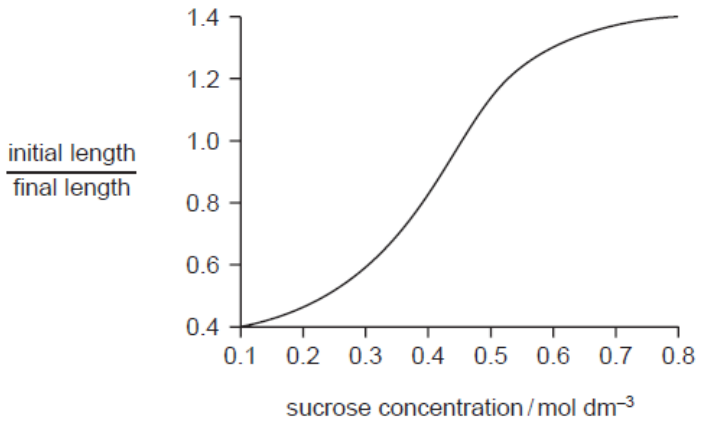


What are **X**, **Y** and **Z**?

	X	Y	Z
A	hydrocarbon chain	hydrocarbon chain	phosphate-containing group
B	hydrocarbon chain	glycerol	phosphate-containing group
C	phosphate-containing group	hydrocarbon chain	hydrocarbon chain
D	phosphate-containing group	glycerol	hydrocarbon chain

55. Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes.

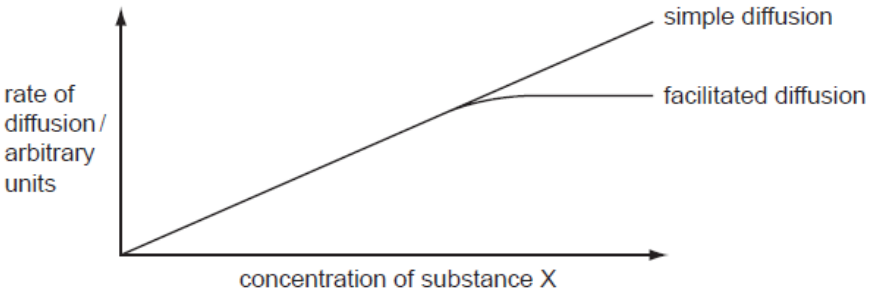
The graph shows the ratio of initial length to final length.



What is a correct description of the change in the cells and in their water potential as the sucrose concentration increases?

	change in the cells	change in the water potential
A	more turgid	less negative
B	less turgid	more negative
C	more turgid	more negative
D	less turgid	less negative

56. The graph shows rates of simple diffusion and facilitated diffusion, of substance X across a cell surface membrane, as the concentration of substance X increases.



Why does the rate of facilitated diffusion level off whereas the rate of simple diffusion does not?

A Facilitated diffusion is limited by the number of protein channels in the membrane.

B Facilitated diffusion is limited by the number of protein pumps in the membrane.

C Facilitated diffusion requires ATP which will eventually be used up.

D Only facilitated diffusion is affected by the kinetic energy of the molecules that are diffusing.

57. Which part of a phospholipid molecule makes up most of the thickness of a cell surface membrane?

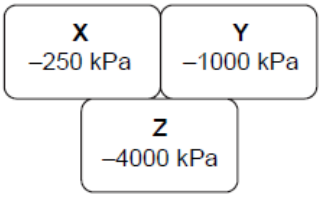
A glycerol

B hydrocarbon chains

C hydrophilic head

D phosphate group

58. The water potential of three adjacent plant cells is shown.



In which direction will water move?

A from cell **X** to cell **Y** and then cell **Z** only

B from cell **X** to both cells **Y** and **Z**

C from cell **Z** to cell **Y** and then cell **X** only

D from cell **Z** to both cells **Y** and **X**

59. The table shows three processes that contribute to transport across cell surface membranes.

Which processes are the result of random movement of molecules?

	diffusion	endocytosis	osmosis
A	✗	✗	✗
B	✗	✓	✓
C	✓	✗	✓
D	✓	✓	✗

key

✓ = random

✗ = non random

60. The epithelial cells of people with cystic fibrosis have a defect in the structure of the cell surface membrane. The ability of the cell to transport chloride ions out of the cell is affected.

Which membrane component is involved?

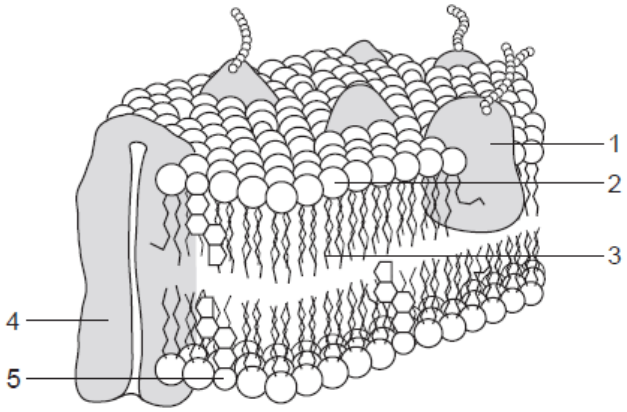
A cholesterol

B glycolipid

C phospholipid

D protein

61. The diagram shows part of the cell surface membrane.



Which components help to maintain the fluidity of the membrane?

A 1 and 3 **B** 1 and 4 **C** 2 and 4 **D** 3 and 5

62. Four solutions, with different water potentials are listed.

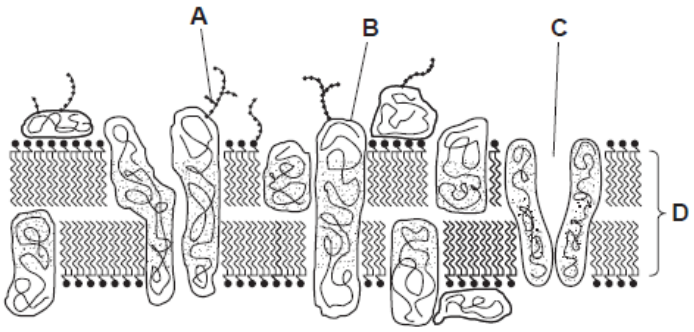
1 endodermal cell solution
2 root hair cell solution
3 soil water solution
4 solution in a xylem vessel

Which list has the solutions in order from the highest (least negative) water potential to the lowest (most negative) water potential?

	highest →			lowest
A	1	2	3	4
B	2	4	1	3
C	3	2	1	4
D	4	1	3	2

63. Cystic fibrosis is a disease where Cl^- ions are unable to be transported into cells.

Which structure in the cell surface membrane is faulty?



64. Diagrams 1 and 2 show how the transverse section through a leaf changes when moved from one solution W to a different solution Y.

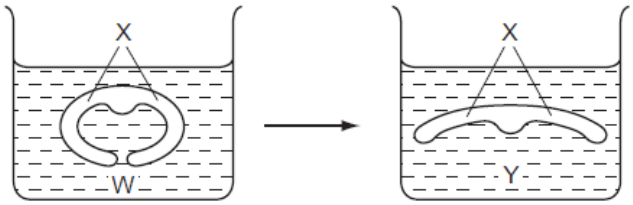
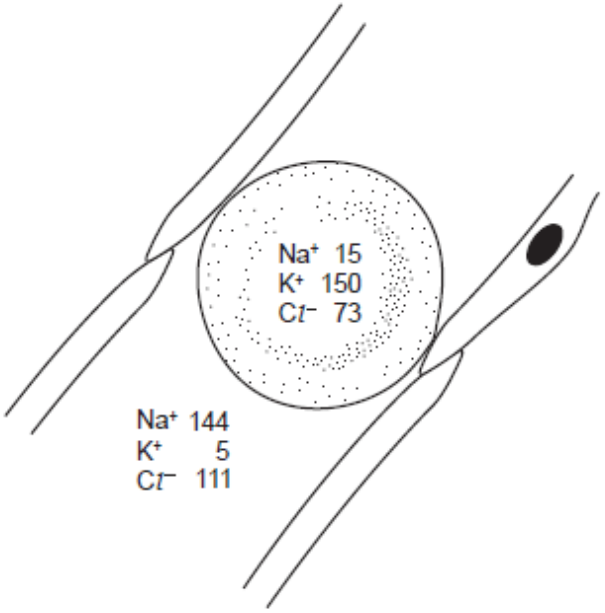


diagram 1 diagram 2

How has the water potential changed in diagram 2?

	difference in cells at X in solution Y compared to the same cells in solution W	difference in solution Y compared to solution W
A	less negative	less negative
B	less negative	more negative
C	more negative	less negative
D	more negative	more negative

65. The diagram shows a red blood cell and the concentrations of ions, in mmol dm^{-3}, in the plasma and in the cell.



Which ions are actively transported into and out of the cell?

	into cell	out of cell
A	Cl^-	K^+
B	K^+	Na^+
C	Na^+	Cl^-
D	Na^+	K^+

68.

Diagrams 1 and 2 show how the transverse section through a leaf changes when moved from one solution W to a different solution Y.

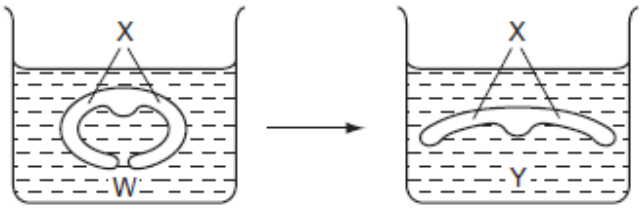


diagram 1 diagram 2

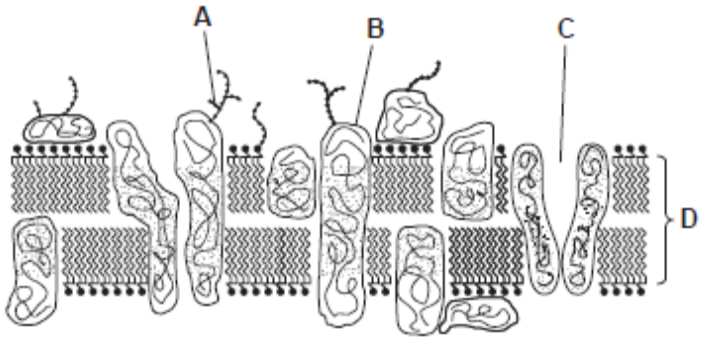
How has the water potential changed in diagram 2?

	difference in cells at X in solution Y compared to the same cells in solution W	difference in solution Y compared to solution W
A	less negative	less negative
B	less negative	more negative
C	more negative	less negative
D	more negative	more negative

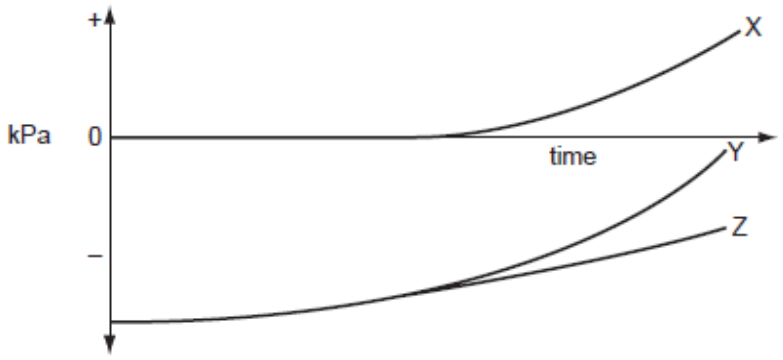
69.

Cystic fibrosis is a disease where Cl^- ions are unable to be transported into cells.

Which structure in the cell surface membrane is faulty?



70. The diagram shows the changes in pressure potential (Ψ_P), solute potential (Ψ_S) and water potential (Ψ) when a plasmolysed plant cell is placed in pure water.



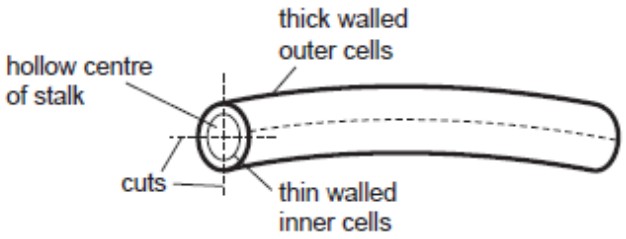
Which shows the correct curves for each potential?

	X	Y	Z
A	Ψ	Ψ_P	Ψ_S
B	Ψ_P	Ψ_S	Ψ
C	Ψ_S	Ψ	Ψ_P
D	Ψ_P	Ψ	Ψ_S

71. Which molecules, found in the cell surface membrane, have the properties listed?

	act as receptor sites for hormones	form hydrogen bonds with water	recognise antibodies
A	cholesterol and proteins	phospholipids and cholesterol	proteins and glycolipids
B	glycolipids and glycoproteins	glycolipids and glycoproteins	glycolipids and glycoproteins
C	phospholipids and cholesterol	proteins and glycolipids	cholesterol and proteins
D	proteins and glycolipids	cholesterol and proteins	phospholipids and cholesterol

72. The stalk of a dandelion is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?

A

B

C

D

73. In an investigation, four sucrose solutions were separated from each other by partially permeable membranes.

1 $1.1\,mol\,dm^{-3}$

2 $0.8\,mol\,dm^{-3}$

3 $0.5\,mol\,dm^{-3}$

4 $0.1\,mol\,dm^{-3}$

Which shows the direction in which water will move between the solutions?

A from 1 and 2 to 3 and 4

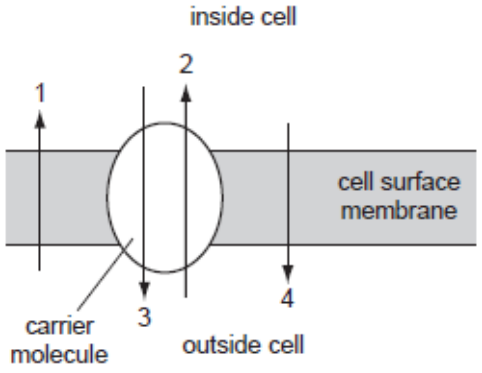
B from 2 and 3 to 1

C from 1 to 3

D from 2 to 4

74. The diagram shows the transport of ions across the cell surface membrane. Inside the cell there is a low concentration of sodium ions (Na^+) and a high concentration of potassium ions (K^+). Outside the cell there is a low concentration of K^+ and a high concentration of Na^+.

The carrier molecule is a pump which exchanges Na^+ for K^+ ions.



Which ionic movements are represented by the arrows?

	active transport of K^+	active transport of Na^+	diffusion of Na^+	diffusion of K^+
A	2	3	1	4
B	2	3	4	1
C	3	2	1	4
D	3	2	4	1

75. Plant cells were immersed in solutions of different water potential and left for one hour.

Which row shows the effect of the different solutions on the plant cells?

	water potential of solution compared to plant cells		
	less negative	equal	more negative
A	flaccid	turgid	unchanged
B	flaccid	unchanged	turgid
C	turgid	unchanged	flaccid
D	unchanged	flaccid	turgid

76. Which molecules, found in cell surface membranes, contribute to cell recognition?

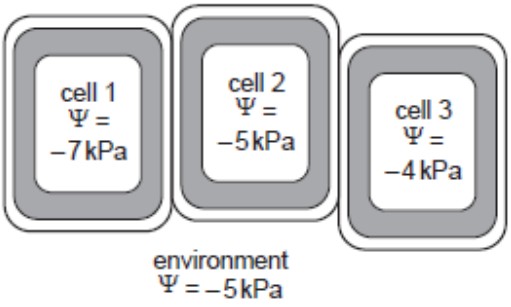
1 glycolipids

2 glycoproteins

3 phospholipids

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

77. The diagram shows the water potential (Ψ) in some plant cells and in their environment.



Which statements are correct for this situation?

1 Water moves into and out of all three cells.

2 There is a net movement of water into cell 1.

3 There is no movement of water from the environment to cell 2.

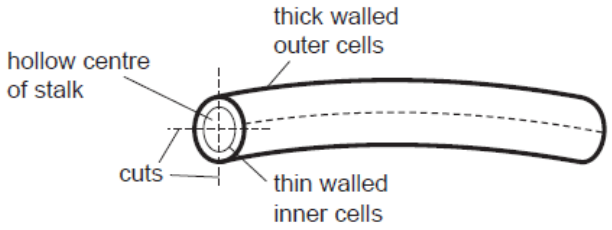
4 Water moves out of cell 3 so it becomes plasmolysed.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

78. Which molecules, found in the cell surface membrane, have the properties listed?

	act as receptor sites for hormones	form hydrogen bonds with water	recognise antibodies
A	cholesterol and proteins	phospholipids and cholesterol	proteins and glycolipids
B	glycolipids and glycoproteins	glycolipids and glycoproteins	glycolipids and glycoproteins
C	phospholipids and cholesterol	proteins and glycolipids	cholesterol and proteins
D	proteins and glycolipids	cholesterol and proteins	phospholipids and cholesterol

79. The stalk of a dandelion is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?

A

B

C

D

80. In an investigation, four sucrose solutions were separated from each other by partially permeable membranes.

1 1.1 mol dm^{-3}

2 0.8 mol dm^{-3}

3 0.5 mol dm^{-3}

4 0.1 mol dm^{-3}

Which shows the direction in which water will move between the solutions?

A from 1 and 2 to 3 and 4

B from 2 and 3 to 1

C from 1 to 3

D from 2 to 4

81. Single-celled animals that live in fresh water have a vacuole that contracts regularly to remove excess water. Single-celled plants that live in fresh water do not have a similar vacuole.

Which statement explains why only these animals need this vacuole?

A Plant cell cytoplasm and animal cell cytoplasm both have a lower water potential than fresh water.

B Plant cell sap has the same water potential as fresh water, animal cytoplasm has a lower water potential than fresh water.

C Plant cell walls are impermeable to water, animal cell surface membranes are permeable to water.

D Plant cell walls restrict the entry of water, animal cell membranes allow the free entry of water.

82. Which statement defines active transport?

A movement of large molecules through the cell surface membrane into the cytoplasm of a cell

B movement of molecules or ions from where they are in a low concentration to where they are in a higher concentration

C movement of molecules or ions from where they are in a high concentration to where they are in a lower concentration

D net movement of water molecules across a partially permeable membrane from a region of higher water potential to one of lower water potential

83. Which statements about the components of the cell surface membrane are correct?

1 Diffusion can take place through lipids and protein pores.

2 Endocytosis only involves lipids.

3 Facilitated diffusion only involves proteins.

4 Osmosis only involves proteins.

A 1, 2, 3 and 4

B 1, 3 and 4 only

C 1 and 3 only

D 2 and 4 only

84. Red blood cells were placed in a solution of sodium chloride with a less negative water potential than the cell contents. Haemoglobin was released from the cells.

By what process was the haemoglobin released?

A active transport

B exocytosis

C facilitated diffusion

D lysis of cell

85. The table shows three processes that contribute to transport across cell surface membranes.

Which processes are the result of random movement of molecules?

	diffusion	facilitated diffusion	osmosis
A	✓	✓	✗
B	✓	✓	✓
C	✗	✓	✓
D	✗	✗	✗

key

✓ = random

✗ = non-random

86. The cell surface membranes of plants adapted to cold conditions change as the weather gets colder, allowing the plants to carry out exocytosis.

Which change occurs?

A a decrease in the ratio of proteins to saturated phospholipids

B a decrease in the ratio of unsaturated phospholipids to saturated phospholipids

C an increase in the ratio of proteins to unsaturated phospholipids

D an increase in the ratio of unsaturated phospholipids to saturated phospholipids

87. Which statement defines active transport?

A movement of large molecules through the cell surface membrane into the cytoplasm of a cell

B movement of molecules or ions from where they are in a low concentration to where they are in a higher concentration

C movement of molecules or ions from where they are in a high concentration to where they are in a lower concentration

D net movement of water molecules across a partially permeable membrane from a region of higher water potential to one of lower water potential

88. Single-celled animals that live in fresh water have a vacuole that contracts regularly to remove excess water. Single-celled plants that live in fresh water do not have a similar vacuole.

Which statement explains why only these animals need this vacuole?

A Plant cell cytoplasm and animal cell cytoplasm both have a lower water potential than fresh water.

B Plant cell sap has the same water potential as fresh water, animal cytoplasm has a lower water potential than fresh water.

C Plant cell walls are impermeable to water, animal cell surface membranes are permeable to water.

D Plant cell walls restrict the entry of water, animal cell membranes allow the free entry of water.

89.	Which statements about the components of the cell surface membrane are correct? 1 Diffusion can take place through lipids and protein pores. 2 Endocytosis only involves lipids. 3 Facilitated diffusion only involves proteins. 4 Osmosis only involves proteins. **A** 1, 2, 3 and 4 **B** 1, 3 and 4 only **C** 1 and 3 only **D** 2 and 4 only

ANSWERS

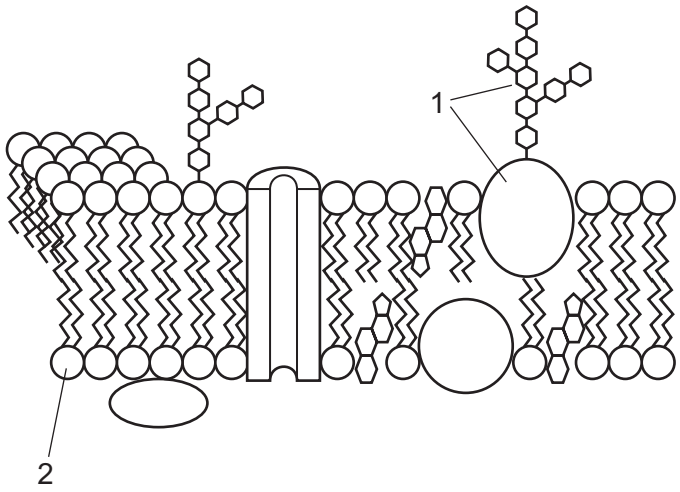
1.	C
2.	A
3.	C
4.	C
5.	B
6.	D
7.	D
8.	B
9.	A
10.	A
11.	B
12.	C
13.	C
14.	B
15.	C
16.	A
17.	B
18.	C
19.	B
20.	B
21.	C
22.	B
23.	C
24.	B
25.	B
26.	D
27.	D
28.	D
29.	D
30.	D

31.	D
32.	C
33.	B
34.	A
35.	C
36.	C
37.	A
38.	B
39.	A
40.	C
41.	A
42.	C
43.	D
44.	B
45.	C
46.	C
47.	C
48.	C
49.	D
50.	D
51.	C
52.	B
53.	C
54.	C
55.	B
56.	A
57.	B
58.	B
59.	C
60.	D

61.	D
62.	C
63.	C
64.	A
65.	B
66.	D
67.	B
68.	A
69.	C
70.	D
71.	B
72.	A
73.	B
74.	A
75.	C
76.	B
77.	A
78.	B
79.	A
80.	**B**
81.	**D**
82.	**B**
83.	**C**
84.	**D**
85.	**B**
86.	**D**
87.	**B**
88.	**D**
89.	**C**

Biology 9700-Paper 1 Year 2024 (O/N) Variant 11

16 The diagram shows part of a cell surface membrane.



Which row correctly identifies the molecules labelled 1 and 2?

	1	2
A	glycoprotein	protein
B	glycolipid	lipoprotein
C	glycoprotein	phosphate head
D	glycolipid	phosphate head

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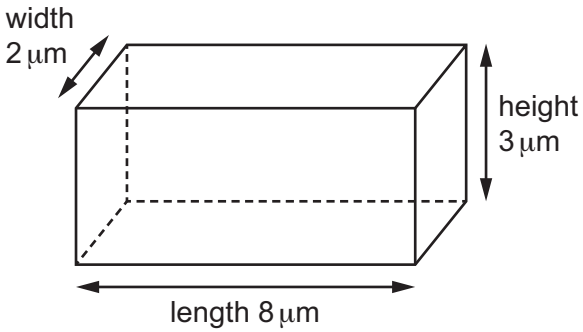
17 The diagram shows the mean dimensions of an epithelial cell in micrometres (μm).



Which row shows the surface area to volume ratio of the epithelial cell and how the surface area to volume ratio of the cell would change if the cell width doubled?

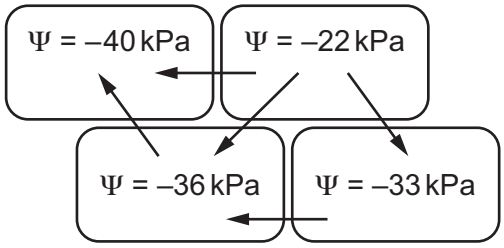
	surface area : volume	how surface area : volume changes if the cell width doubled
A	12 : 23	decreases
B	12 : 23	increases
C	23 : 12	decreases
D	23 : 12	increases

18 Which diagram shows the correct direction of net water movement between the four cells due to osmosis?

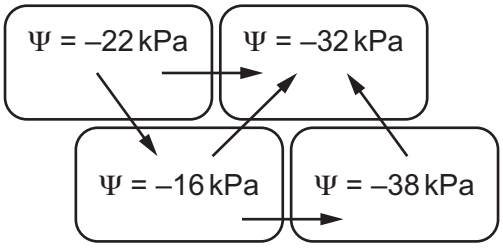
key

Ψ = water potential

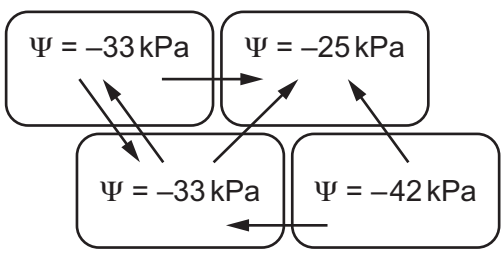
A



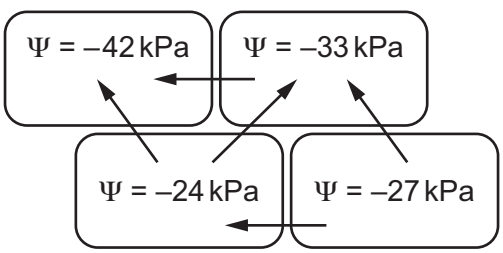
B



C



D



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19 An investigation was carried out into the effect of four different treatments on the permeability of the cell surface membranes and tonoplasts of beetroot cells. Beetroot cell vacuoles contain a red pigment. This pigment **cannot** diffuse through the tonoplasts or cell surface membranes.

1 cm^3 cubes were cut from beetroot tissue and washed in running water for 20 minutes to remove any pigment released from damaged cells.

Two cubes were then placed in each of the four test-tubes containing different contents and observed for five minutes.

Which row shows a correct explanation for the observation recorded for one of the treatments?

	treatment	observation	explanation
A	dilute hydrochloric acid	contents of test-tube stay clear	membrane proteins have been denatured
B	ethanol	contents of test-tube turn red	lipids, including membrane phospholipids, have dissolved
C	water at 20 °C	contents of test-tube stay clear	membrane proteins have been denatured
D	water at 80 °C	contents of test-tube turn red	lipids, including membrane phospholipids, have dissolved

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14 Phospholipids are formed in a similar way to triglycerides.

A sample contained six phospholipid molecules.

- The molecular weight of a phosphate ion is 95 g mol^{-1}.
- The molecular weight of each individual fatty acid in this sample was found to be 282 g mol^{-1}.
- The molecular weight of glycerol is 92 g mol^{-1}.
- The molecular weight of water is 18 g mol^{-1}.

What is the molecular weight of the sample in g mol^{-1}?

A 2598 **B** 4182 **C** 4506 **D** 4830

15 Which statements about phospholipids in cell surface membranes are correct?

1 Fatty acid tails allow most ions to pass through the membrane.

2 Hydrophobic tails point inwards facing each other.

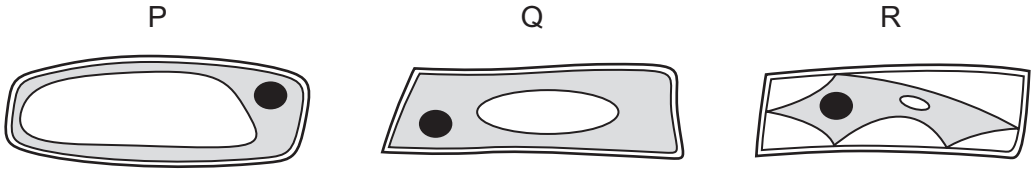
3 All polar heads face the cytoplasm.

4 The phospholipids help with the flexibility of the membrane.

A 1, 2 and 3 **B** 1 and 3 only **C** 2, 3 and 4 **D** 2 and 4 only

16 In an experiment, pieces of onion epidermis are put into three different concentrations of sucrose solutions, P, Q and R. The pieces of onion are left for an hour and then examined using the low power of a light microscope.

Each diagram shows one cell from the epidermis that was placed in each of the sucrose concentrations.



What explains the appearance of cells in solution Q?

A The concentration of solution Q is equal to the concentration of the solutes in the cell sap.

B The cytoplasm has the same concentration of sucrose as solution Q.

C The water potential of the cytoplasm is equal to the water potential of the vacuole.

D The water potential of the cell sap is equal to the water potential of solution Q.

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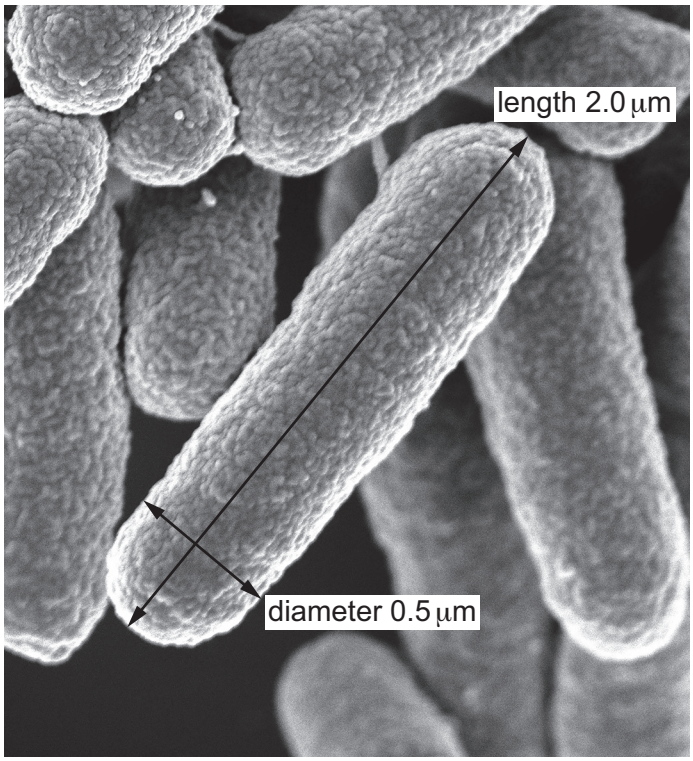
17 The electron micrograph shows rod-shaped bacteria.



The actual length of the bacterium is 2.0 μm and the diameter is 0.5 μm. Assume that the bacterium is cylinder-shaped.

What is the surface area to volume ratio of the bacterium?

A 3.0 : 1.0 **B** 5.0 : 1.0 **C** 8.0 : 1.0 **D** 9.0 : 1.0

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Biology 9700-Paper 1 Year 2024 (O/N) Variant 13

14 Before mitochondria are extracted from cells for microscopy, they are usually kept in a $0.25\,mol\,dm^{-3}$ sucrose solution.

Why is the sucrose solution used?

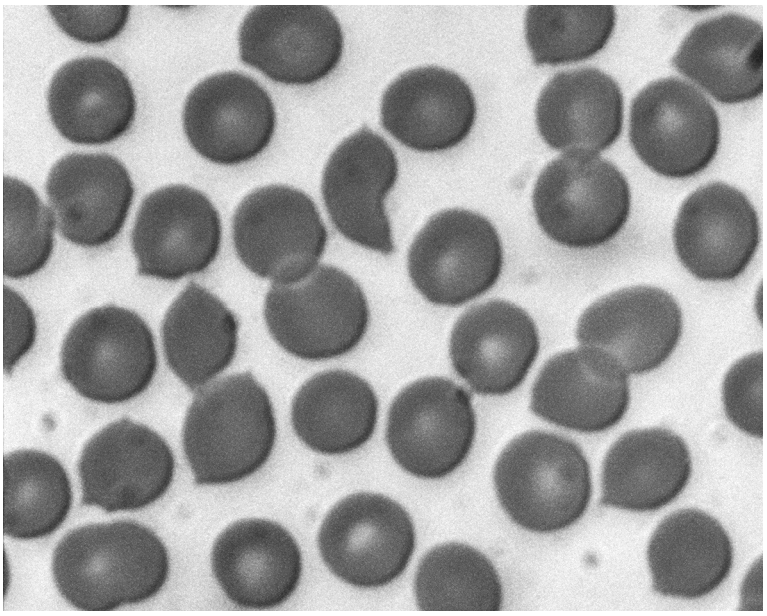
A to act as a solvent

B to enable the rate of reaction of the mitochondria to be determined

C to prevent the mitochondria from changing in dimension

D to provide a source of energy

15 The photomicrograph shows a type of blood cell.



Which statements about these cells are correct?

1 Oxygen diffuses through the phospholipid bilayer.

2 Sodium ions diffuse through the phospholipid bilayer.

3 Water passes in and out of these cells by osmosis.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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16 Which row is correct for parts of a phospholipid molecule?

	can be saturated or unsaturated	can also be found in a triglyceride
A	head	tail
B	tail	head
C	head	head
D	tail	tail

17 A student filled dialysis tubing with a sucrose solution and knotted both ends. This formed a cylinder with a length of 5.0 cm and a radius of 2.0 cm.

What is the surface area to volume ratio for this cylinder of dialysis tubing?

A 0.7 : 1.0 **B** 1.0 : 1.0 **C** 1.4 : 1.0 **D** 2.5 : 1.0

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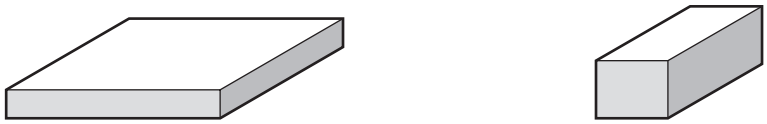
Biology 9700-Paper 1 Year 2025 (MARCH)

16 The diagram shows the dimensions of two blocks of agar. The diagram has been drawn to scale.



width	30 mm	width	10 mm
length	20 mm	length	15 mm
height	4 mm	height	8 mm

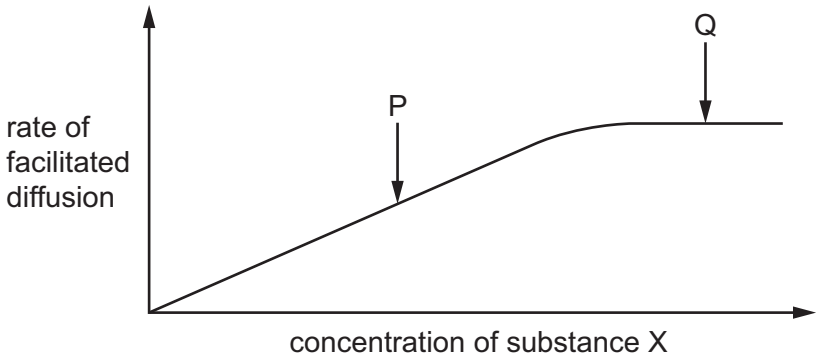
The blocks of agar were stained pink with a pH indicator. In acidic conditions, the pink pH indicator becomes colourless.

The two blocks of agar were placed in a beaker of acid at the same time. As the acid diffused into the blocks, the blocks became colourless.

What is the surface area to volume ratio of the block that became completely colourless first?

A 0.58 : 1 **B** 0.67 : 1 **C** 1.50 : 1 **D** 1.71 : 1

17 The graph shows how the rate of facilitated diffusion of substance X across a cell surface membrane changed as the concentration of substance X increased. All conditions, except for the concentration of substance X, were kept constant. Temperature was maintained at 15 °C.



Which statement about the rate of facilitated diffusion is correct?

A The rate of facilitated diffusion of substance X at Q will increase if the temperature is increased to 20 °C.

B The rate of facilitated diffusion of substance X at P will increase if the concentration of ATP is increased.

C The rate of facilitated diffusion of substance X at Q will increase if the concentration of substance X is increased.

D The rate of facilitated diffusion of substance X at P will increase if the length of time over which the rate is measured is increased.

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18 Which molecule forms a bilayer in the cell surface membrane of a bacterial cell?

A fatty acid

B peptidoglycan

C phospholipid

D cholesterol

Biology 9700-Paper 1 Year 2025 (M/J) Variant 11

17 The cell surface membrane structure is described as a 'fluid mosaic'.

What correctly describes the 'mosaic' part of the cell surface membrane?

A the different patterns that are obtained by the moving phospholipid molecules

B the random distribution of cholesterol molecules within the phospholipid bilayer

C the regular pattern produced by the phospholipid heads and membrane proteins

D the scattering of the different proteins within the phospholipid bilayer

18 A student immersed a plant tissue in solution S.

For the next 30 minutes, the student used a microscope to observe the cells in the plant tissue.

During this time, the cytoplasm of the cells shrunk and no longer pushed up against the cell wall. In many cells, a space appeared between the cytoplasm and the cell wall.

Which statements are correct conclusions from these observations?

1 The water potential in solution S was more negative than the water potential in the cytoplasm of the cells at the start of the experiment.

2 Without a cell wall to provide support, it is likely that many of the cells would have burst.

3 The clear space between the cell wall and the cytoplasm of many of the cells was filled with air.

A 1 and 3 **B** 1 only **C** 2 and 3 **D** 2 only

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17 Cell membranes become less fluid as the temperature decreases.

Bacteria and yeast cannot regulate their cell temperatures.

How do bacteria and yeast maintain the fluidity of their cell membranes when the temperature decreases?

1 They increase the numbers of unsaturated fatty acids in their phospholipid molecules.

2 They increase the numbers of saturated fatty acids in their phospholipid molecules.

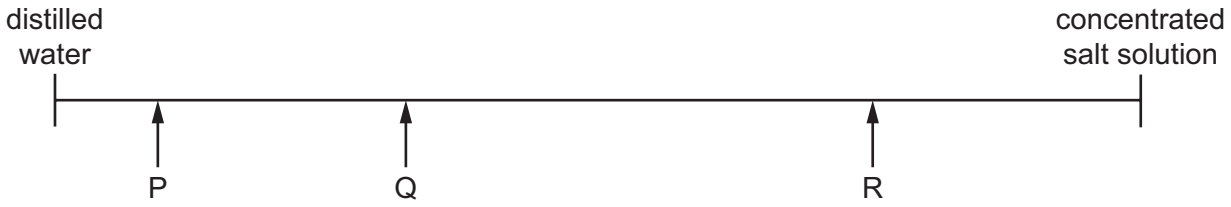
3 They increase the numbers of cholesterol molecules in their cell membranes.

A 1 and 3 **B** 1 only **C** 2 and 3 **D** 2 only

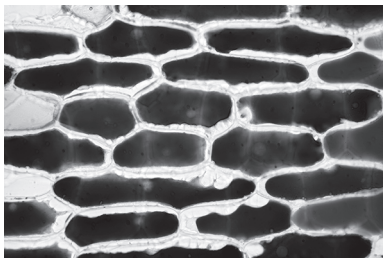
18 Samples X, Y and Z are epidermal tissues cut from an onion. Each epidermal tissue was immersed in one of three different concentrations of a salt solution for 30 minutes.

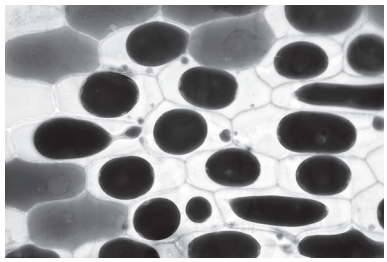
A student observed each tissue sample with a light microscope. Then the student estimated the concentration of each salt solution using a scale.

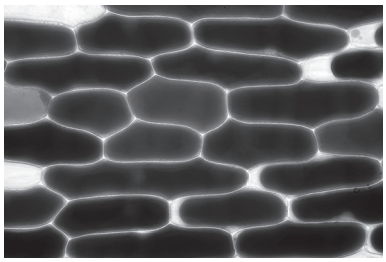
The diagram shows the scale. P, Q and R represent the estimated concentration of the three salt solutions.



The photomicrographs show the appearance of the tissues in samples X, Y and Z.


sample X


sample Y


sample Z

Which row shows the estimated concentrations of the salt solutions in which samples Y and Z were immersed?

	sample Y	sample Z
A	P	Q
B	P	R
C	Q	R
D	R	P

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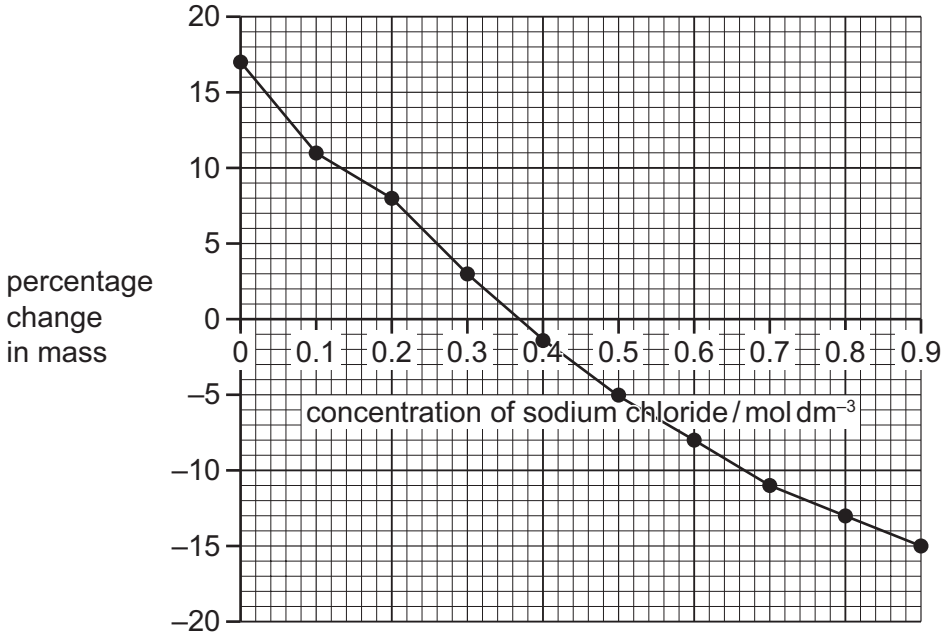
19 The graph shows the results of an osmosis investigation using potato tissue.



What is the concentration of sodium chloride solution that has the equivalent water potential to this potato tissue and what is correct about the movement of water at that point?

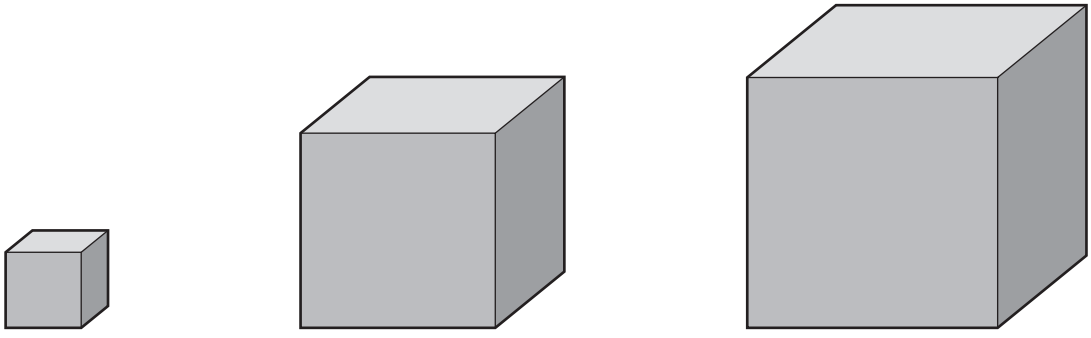
A 0.37 mol dm^{-3} and no net movement of water

B 17 mol dm^{-3} and net movement of water out of the potato tissue

C 0 mol dm^{-3} and no net movement of water

D 0.9 mol dm^{-3} and net movement of water into the potato tissue

20 Some agar was coloured pink using a pH indicator. The pink agar was then used to make three agar cubes with different dimensions.



2 cm × 2 cm × 2 cm

4 cm × 4 cm × 4 cm

5 cm × 5 cm × 5 cm

The cubes were placed in a beaker and covered with 0.1 mol dm^{-3} hydrochloric acid. The temperature of the experiment was standardised at 20 °C.

Hydrochloric acid diffused into the agar cubes causing the cubes to become colourless.

What is the surface area to volume ratio of the agar cube that became colourless in the **least** amount of time?

A 0.33 : 1 **B** 0.83 : 1 **C** 1.2 : 1 **D** 3.0 : 1

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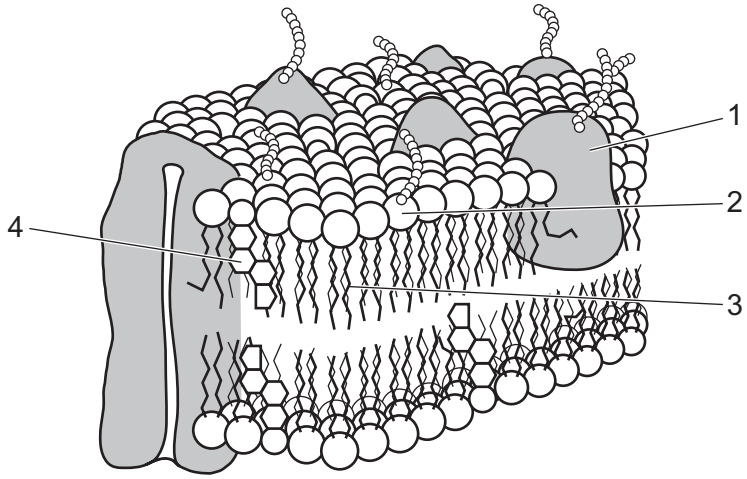
17 The diagram shows part of a eukaryotic cell surface membrane.



Which components act as antigens in cell surface membranes?

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 and 4

18 Descriptions of three biological molecules found in cell surface membranes are given.

- X is a molecule comprised of carbon, hydrogen and oxygen, with a non-polar region and one region that extends out of the membrane capable of forming hydrogen bonds.
- Y is a molecule with a hydrophilic end that forms hydrogen bonds with the water outside the membrane, and a hydrophilic region that is located within the cell membrane.
- Z is a molecule that can position itself within the membrane due to a hydrophilic region at one end and two hydrophobic extensions that are positioned within the membrane.

Which row correctly identifies a carrier protein and a glycolipid?

	carrier protein	glycolipid
A	X	Z
B	X	Y
C	Z	Y
D	Y	X

19 Antimycin is a chemical that inhibits the function of mitochondria.

Which methods of transport across the cell surface membrane could be directly affected by antimycin?

1 active transport

2 facilitated diffusion

3 endocytosis

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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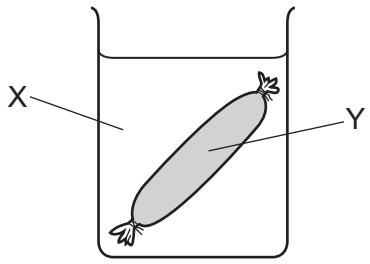
20 A student half filled a beaker with solution X. They placed a sealed Visking tubing bag containing solution Y into the beaker.



At 30 minutes, the solution in the beaker was orange and the solution inside the Visking tubing was blue-black.

What did solutions X and Y contain at the start to give these results?

	solution X	solution Y
A	starch	amylase and iodine
B	iodine	amylase
C	starch and amylase	iodine
D	iodine	starch

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17 Which of these substances can pass directly through cell surface membranes **without** using a carrier protein or channel protein?

1 K^+ and Cl^-

2 CO_2

3 $C_6H_{12}O_6$

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 only

18 Which of these statements about facilitated diffusion are correct?

1 It is limited by the number of transport proteins.

2 It transports molecules against their concentration gradient.

3 It requires a source of ATP.

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

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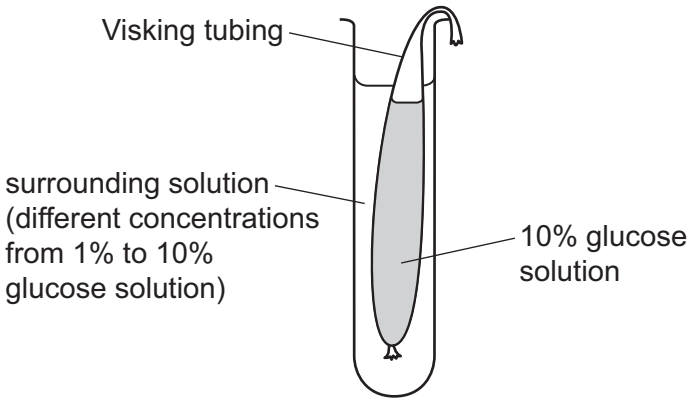
19 A cell absorbs amino acids. This cell then synthesises and exports a digestive enzyme. Different cell structures are involved with different stages of this process.

Which row shows a possible sequence of cell structures that the amino acids pass through?

	cell surface membrane	Golgi body	rough endoplasmic reticulum	secretory vesicle
A	1st	2nd	3rd	4th
B	1st	3rd	4th	2nd
C	4th	2nd	1st	3rd
D	4th	1st	2nd	3rd

20 The diagram shows apparatus set up to investigate the effect of changing the initial concentration of glucose in the surrounding solution on the movement of molecules through a selectively permeable membrane (Visking tubing) in 15 minutes.



Which statements are correct as the initial concentration of glucose solution in the surrounding solution increases?

1 Net diffusion of water increases.

2 Glucose molecules reach an equilibrium quicker.

3 There is less change in the volume of the surrounding solution.

4 Net diffusion of glucose increases.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 3 only

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